National Cancer Institute
National Institutes of Health
U.S. Department of Health and Human Services

NCI Strategic Workshop

Biomimetic Tissue Engineered Systems for Advancing Cancer Research

February 26, 2014
NCI Shady Grove Campus
9609 Medical Center Drive
Rockville, Maryland
Terrace Room TE406
8:00 a.m. – 5:30 p.m.

AGENDA

Meeting Objectives

Building on great progress at the convergence of physical sciences and oncology, we envision the development of new research areas centered on harnessing biomimetic systems used in tissue engineering and regenerative medicine to advance cancer research. Recapitulation of tumors and their context *in vitro* has been a challenge for cancer researchers. Notable advances have been made in cancer biology with 3D culture systems using biomimetic and natural biomaterials, microfluidic devices, and co-cultures. However, further technological developments must be achieved in order to create dynamic *in vitro* model systems that include multiple cellular, chemical, and physical parameters, all of which are important players in cancer biology. The field of tissue engineering and regenerative medicine has made advances in developing *in vitro* and *ex vivo* model systems to recreate tissues and their microenvironment. At this workshop we will assess the next steps for developing tissue engineered systems for cancer research and to determine what type of infrastructure or funding support may be required to advance current technologies.

7:30 a.m. - 8:00 a.m.	Security and Registration
8:00 a.m. - 8:05 a.m.	Welcome and Opening Remarks Dinah Singer, Ph.D. National Cancer Institute
8:05 a.m. - 8:15 a.m.	Introduction and Goals of Workshop Nastaran Kuhn, Ph.D. National Cancer Institute
8:15 a.m. - 8:45 a.m.	Keynote Presentation: From Cancer Biomechanics to Human Organ-on-Chip Disease Models Donald Ingber, M.D., Ph.D. Wyss Institute, Harvard University

8:45 a.m. - 10:25 a.m. Session I: Vascularized Tissue Engineered Systems for Cancer Research
Scribe: Xin Yi Chan, Ph.D., Johns Hopkins University

8:45 a.m. - 8:50 a.m. Introduction by Session Moderator
Sharon Gerecht, Ph.D.
Johns Hopkins University

8:50 a.m. - 9:10 a.m. Vascularizing Engineered Tumor Tissue *in Vitro*
Steven George, MD., Ph.D.
University of California, Irvine

9:10 a.m. - 9:30 a.m. Engineering Realistic Microvessel Tumor Systems for Studying Metastasis
Christopher Chen, M.D., Ph.D.
Boston University

9:30 a.m. - 9:50 a.m. Bioengineering of Tissue Models for Cancer and Metastasis Research
Shay Soker, Ph.D.
Wake Forest School of Medicine

9:50 a.m. - 10:25 a.m. Panel Questions and Discussion
Panel: Donald Ingber, Steven George, Christopher Chen, Shay Soker
Moderated by Sharon Gerecht

10:25 a.m. - 10:40 a.m. Break

10:40 a.m. - 12:00 p.m. Session II: Biomimetic Systems to Probe the Cancer Physical Microenvironment
Scribe: Ioannis Zervantonakis, Ph.D., Harvard University

10:40 a.m. - 10:45 a.m. Introduction by Session Moderator
Sanjay Kumar, M.D., Ph.D.
University of California, Berkeley

10:45 a.m. - 11:00 a.m. Microenvironmental Factors Regulating Establishment of Tumors in Bone
Scott Guelcher, Ph.D.
Vanderbilt University

11:00 a.m. -11:15 a.m. Biomimetic System for Probing Metastatic Efficiency in Secondary Organs
Joyce Wong, Ph.D.
Boston University

11:15 a.m. - 11:30 a.m. Gelatin-based Hydrogel Models of Glioblastoma
Brendan Harley, Sc.D.
University of Illinois, Urbana-Champaign

11:30 a.m. - 12:00 p.m. Panel Questions and Discussion
Panel: Scott Guelcher, Joyce Wong, Brendan Harley
Moderated by Sanjay Kumar

12:00 p.m. - 1:15 p.m. Lunch

12:35 p.m. - 1:15 p.m. Poster Viewing in Terrace Room TE406

1. David Beebe, Ph.D., Wisconsin Institute for Medical Research
   Microscale in vitro Models Enable Cancer Research and Translation
2. Jennifer Elisseeff, Ph.D., Johns Hopkins University
   The Independent Roles of Mechanical, Structural and Adhesion Characteristics of 3D Hydrogels on the Regulation of Cancer Invasion and Dissemination
3. Cynthia Reinhart-King, Ph.D., Cornell University
   Tissue-Engineered Models of Follow-the-Leader Metastatic Migration
4. Laura Suggs, Ph.D., University of Texas, Austin
   Dynamically Tunable Gels to Probe the Influence of Stiffness on Tumor Progression
5. Min Kim, M.D., Weill Cornell Medical College, Houston Methodist
   Tumor Cells in the Circulating Media of the 4D Model Mimics the Circulating Tumor Cell Biology
6. Lance Munn, Ph.D., Harvard University
   Biomimetic Microsystems for Neovascularization and Cell Sorting
7. Shannon Mumenthaler, Ph.D., University of Southern California
   A Bioengineered Liver Tissue platform for studying cancer Metastasis
8. Meenakshi Upreti, Ph.D. , University of Kentucky
   The Tumor Microenvironment and 3-D Tumor Models: Implications in Biology and Therapy

1:15 p.m. - 1:45 p.m. Keynote Presentation: Integrating Systems Biology and Tissue Engineering for Models of Cancer Dormancy and Drug Efficacy
Linda Griffith, Ph.D.
Massachusetts Institute of Technology

1:45 p.m. - 3:45 p.m. Session III: Correlation of Molecular Phenotypes and Tissue Function with Biomimetic Systems
Scribe: Aranzazu Villasante, Ph.D., Columbia University

1:45 p.m. - 1:50 p.m. Introduction by Session Moderator
Michael Shuler, Ph.D.
Cornell University

1:50 p.m. - 2:10 p.m. Tumor Engineering: Lessons from Regenerative Medicine
Gordana Vunjak-Novakovic, Ph.D.
Columbia University

2:10 p.m. -2:30 p.m. Drug Sensitivity of Ewing Sarcoma Cells in 3D Biomimetic Substrates
Joseph Ludwig, M.D.
MD Anderson Cancer Center

2:30 p.m. - 2:50 p.m. Screening of Novel CRC Loci from Genome-scale Cancer Surveys in a Primary Colon Organoid System
Calvin Kuo, M.D., Ph.D.
Stanford University

2:50 p.m. - 3:10 p.m. Identifying Molecular Markers of Breast Epithelial Dissemination using Engineered Microenvironment Systems
Andrew Ewald, Ph.D.
Johns Hopkins University

3:10 p.m. - 3:45 p.m. **Panel Questions and Discussion Session**
Panel: Linda Griffith, Gordana Vunjak-Novakovic, Joseph Ludwig, Calvin Kuo, Andrew Ewald
Moderated by Michael Shuler

3:45 p.m. - 4:05 p.m. **Break**

4:05 p.m. - 4:45 p.m. **Breakout Discussions**
Moderator: Larry Nagahara, Ph.D., National Cancer Institute

Scribes:
Joyce Chen, Cornell University
Kyungmin Ji, Wayne State University
Kyung Min Park, Ph.D., Johns Hopkins University
Alireza Roshan Ghias, Ph.D., Columbia University
Teresa Schuessler, M.S., National Cancer Institute
Pallavi Sethi, Ph.D., University of Kentucky
Archana Thakur, Ph.D., Wayne State University
Xi Tian, Ph.D., University of North Carolina

- Identify 3 outstanding cancer research questions that can be addressed with biomimetic tissue engineered systems
- Identify 1 or more technological advancements needed to advance the field
- Identify the " ideal team" for applying tissue engineering tools to cancer research

4:45 p.m. - 5:25 p.m. **Breakout Summaries**
Moderator: Larry Nagahara, Ph.D., National Cancer Institute

5:25 p.m. - 5:30 p.m. **Closing Remarks**
Nastaran Kuhn, Ph.D.
National Cancer Institute

NCI Planning Committee

Division of Cancer Biology
Dan Gallahan, Ph.D.
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